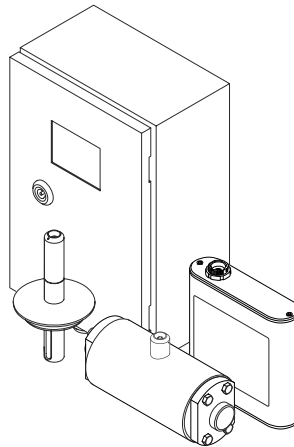


# Brief Operating Instructions

## Teqwave H

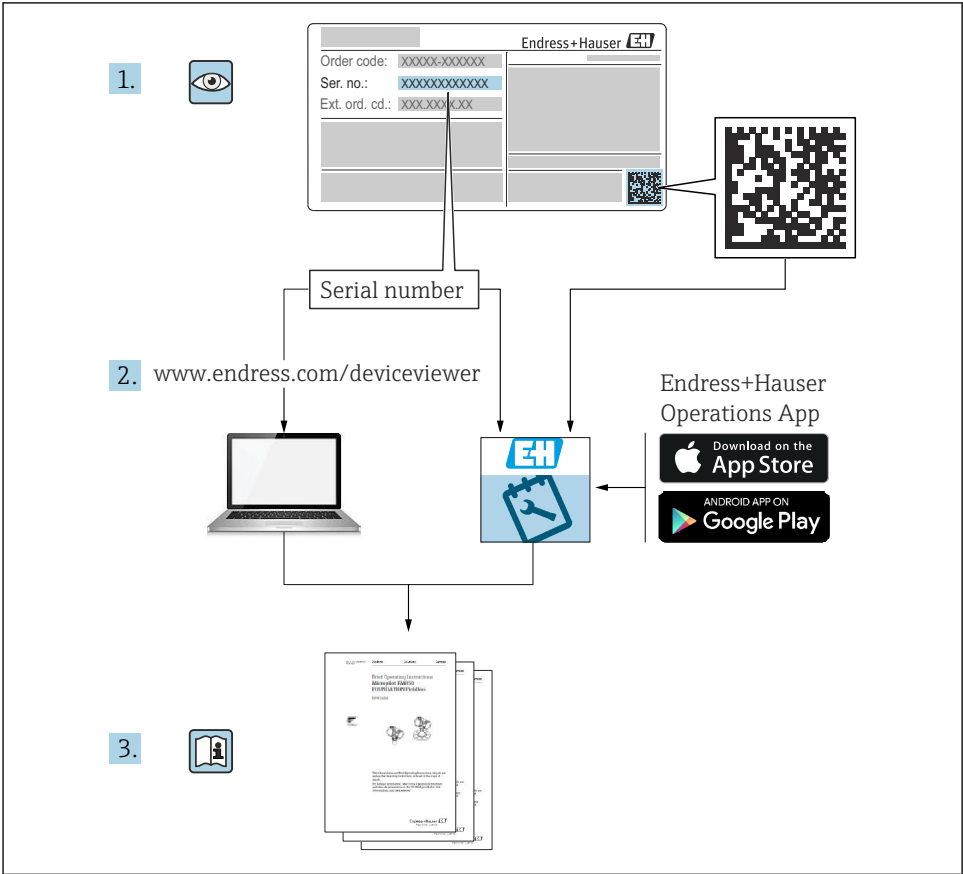
Ultrasonic concentration meter



These Brief Operating Instructions are **not** a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:

- Internet: [www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)
- Smartphone/tablet: *Endress+Hauser Operations app*



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# 1 About this document

## 1.1 Symbols

### 1.1.1 Safety symbols

** DANGER**

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

** WARNING**

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

** CAUTION**

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

**NOTICE**

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

### 1.1.2 Symbols for certain types of information

| Symbol                                                                              | Meaning                                                                  | Symbol                                                                              | Meaning                                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
|    | <b>Permitted</b><br>Procedures, processes or actions that are permitted. |    | <b>Preferred</b><br>Procedures, processes or actions that are preferred. |
|    | <b>Forbidden</b><br>Procedures, processes or actions that are forbidden. |    | <b>Tip</b><br>Indicates additional information.                          |
|   | Reference to documentation                                               |   | Reference to page                                                        |
|  | Reference to graphic                                                     |  | Series of steps                                                          |
|  | Result of a step                                                         |  | Visual inspection                                                        |

### 1.1.3 Electrical symbols

| Symbol                                                                              | Meaning                                | Symbol                                                                              | Meaning                                                                                                                         |
|-------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|  | Direct current                         |  | Alternating current                                                                                                             |
|  | Direct current and alternating current |  | <b>Ground connection</b><br>A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |

| Symbol                                                                            | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Potential equalization connection (PE: Protective earth)</b><br>Ground terminals that must be connected to ground prior to establishing any other connections.<br>The ground terminals are located on the interior and exterior of the device: <ul style="list-style-type: none"> <li>■ Interior ground terminal: potential equalization connection is connected to the supply network.</li> <li>■ Exterior ground terminal: the device is connected to the plant grounding system.</li> </ul> |

#### 1.1.4 Tool symbols

| Symbol                                                                            | Meaning              | Symbol                                                                            | Meaning                |
|-----------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------|------------------------|
|  | Torx screwdriver     |  | Flat-blade screwdriver |
|  | Phillips screwdriver |  | Allen key              |
|  | Open-end wrench      |                                                                                   |                        |

#### 1.1.5 Symbols in graphics

| Symbol                                                                            | Meaning        | Symbol                                                                            | Meaning                        |
|-----------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------|--------------------------------|
| 1, 2, 3,...                                                                       | Item numbers   |  | Series of steps                |
| A, B, C, ...                                                                      | Views          | A-A, B-B, C-C, ...                                                                | Sections                       |
|  | Hazardous area |  | Safe area (non-hazardous area) |
|  | Flow direction |                                                                                   |                                |

## 2 Safety instructions

### 2.1 Requirements for the personnel

The personnel must fulfill the following requirements for its tasks:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ▶ Are authorized by the plant owner/operator.
- ▶ Are familiar with federal/national regulations.
- ▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

## 2.2 Intended use

To ensure that the measuring instrument remains in proper condition during the operating time:

- ▶ Only use the measuring instrument in full compliance with the data on the nameplate and the general conditions listed in the manual and supplementary documentation.
- ▶ Using the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- ▶ Use the measuring instrument only for media to which the process-wetted materials are sufficiently resistant.
- ▶ Keep within the specified pressure and temperature range.
- ▶ Keep within the specified ambient temperature range.
- ▶ Protect the measuring instrument permanently against corrosion from environmental influences.

### Incorrect use

Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

#### WARNING

#### **Danger of breakage due to corrosive or abrasive fluids and ambient conditions!**

- ▶ Verify the compatibility of the process fluid with the sensor material.
- ▶ Ensure the resistance of all wetted materials during the process.
- ▶ Keep within the specified pressure and temperature range.

#### WARNING

#### **Risk of injury if the process connection and sensor gland are opened under pressure.**

- ▶ The process connection should be opened only when in an unpressurized state.

### Residual risks

#### WARNING

#### **Risk of hot or cold burns! Hot or cold surfaces on the device may occur due to the process medium or ambient temperature.**

- ▶ Mount suitable touch protection.

## 2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.

## 2.4 Operational safety

Damage to the device!

- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for the interference-free operation of the device.

## 2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

## 2.6 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

# 3 Product description

The measuring system consists of a sensor and a transmitter. The sensor and transmitter are mounted in physically separate locations. A connecting cable with a push-pull connector interconnects the sensor and transmitter.

The measuring system uses fluid profiles, which are individually tailored to the specific measuring task and encoded to work only with the serial number of a specific transmitter.

## 3.1 Product design

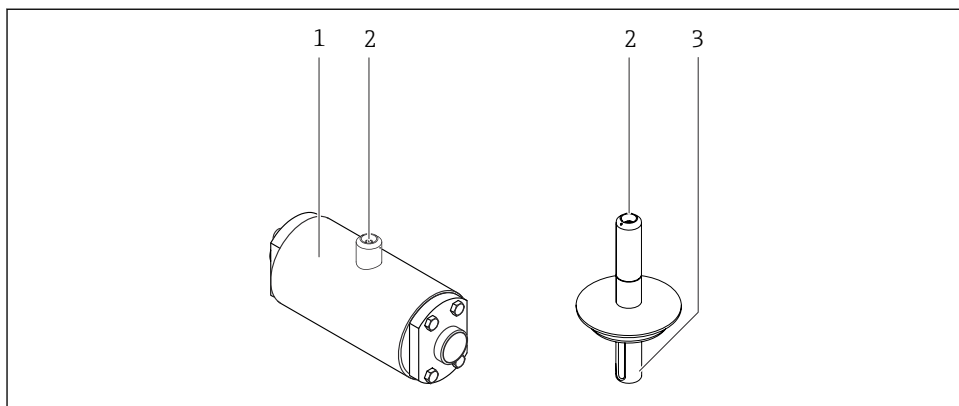
Two sensor versions are available:

- Inline sensor
- Insertion sensor

Two transmitter versions are available:

- Transmitter with aluminum housing
- Transmitter with stainless steel housing

### 3.1.1 Sensor



A0060221

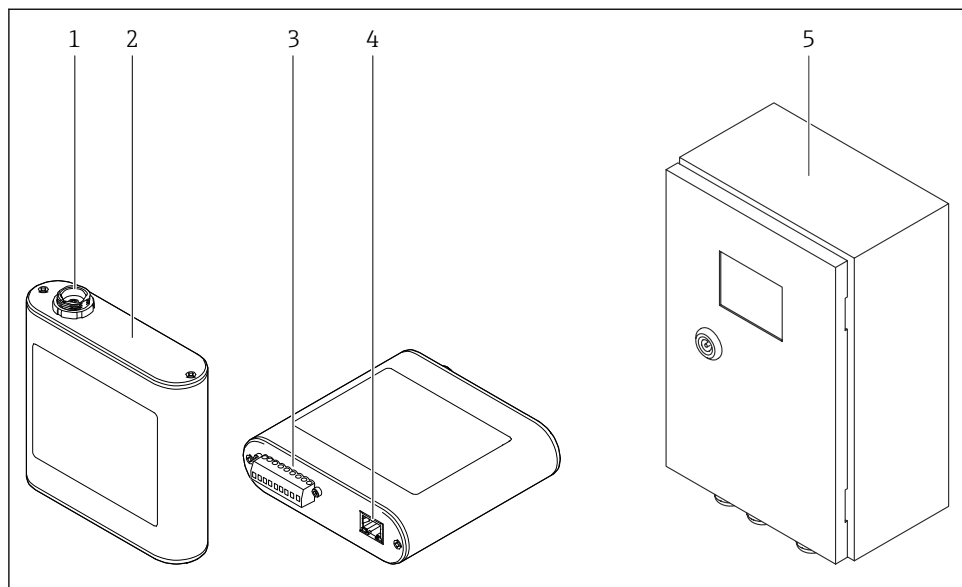
#### 1 Sensor versions

- 1 *Inline sensor*
- 2 *Push-pull connection for connecting to the transmitter*
- 3 *Insertion sensor*

 Only use the connecting cable supplied. The connecting cable can be ordered subsequently as an accessory .



### 3.1.2 Transmitter



A0060220

#### 2 Transmitter versions

- 1 Push-pull connection for connecting to the sensor
- 2 Transmitter with aluminum housing and with a touchscreen
- 3 Terminal strip with supply voltage, analog output, switch output and digital input
- 4 Ethernet interface for digital signal transmission ("Teqwave Viewer" operating tool and Modbus protocol)
- 5 Transmitter with stainless steel housing

 Only use the connecting cable supplied. The connecting cable can be ordered subsequently as an accessory .

## 3.2 Fluid profiles

Endress+Hauser makes individually configured fluid profiles available for each fluid. A fluid profile contains the characteristics of the speed of sound in a defined temperature range. These values are needed to calculate the concentration of a liquid. Each fluid profile is uniquely identified by a five-digit number (#MA-xxxxx).

The data sheet belonging to a fluid profile contains information on the medium, analysis parameters, permitted measuring ranges, compensation values and accuracy of the concentration measurement.

When individual fluid profiles are ordered, they are pre-installed on the transmitter and can be used immediately. When ordering an application, only common fluid profiles are initially installed on the transmitter. All the ordered fluid profiles are always available via *Netilion*.

Apart from the preconfigured fluid profiles which are available by default, Endress+Hauser also creates individual fluid profiles specifically for your application.



Your Endress+Hauser sales organization can provide detailed information on this service.

### 3.3 Recipes

With the "Teqwave Viewer" operating tool, it is also possible to customize a fluid profile to specific customer requirements and save the changes as a recipe.

When creating a recipe, an offset (zero adjustment) can be defined. This adjustment with a reference system is recommended during commissioning in order to optimize measurement accuracy.

In addition, other measured values can be read in or entered manually to compensate for cross-interferences of certain fluid profiles (e.g. for acids that influence concentration measurement).

Each transmitter can manage a maximum of 50 files (fluid profiles and recipes), including a maximum of 25 fluid profiles.



- To enable storage space for creating recipes, unused fluid profiles can be removed from the transmitter.
- For details on creating recipes, see → 41.

### 3.4 Application options

The measuring instrument offers application-specific options for selecting and ordering appropriate measured variables and fluid profiles.

For information about the options available, see the "Measuring system" section of the "Technical Information" document.



- A selection of common fluid profiles for this area of application is already pre-installed upon delivery.
- To enable storage space for creating recipes, unused fluid profiles can be removed from the transmitter.
- All the fluid profiles of an ordered application are always available via *Netilion* and can be added to the transmitter.

## 4 Installation

### 4.1 Installation requirements

#### 4.1.1 Installation position

##### NOTICE

##### Measurement result is not representative

Heterogeneous mixing of the fluid and irregular flow to the medium can distort the measurement results, which are only valid for the layer of liquid in which the sensor is located.

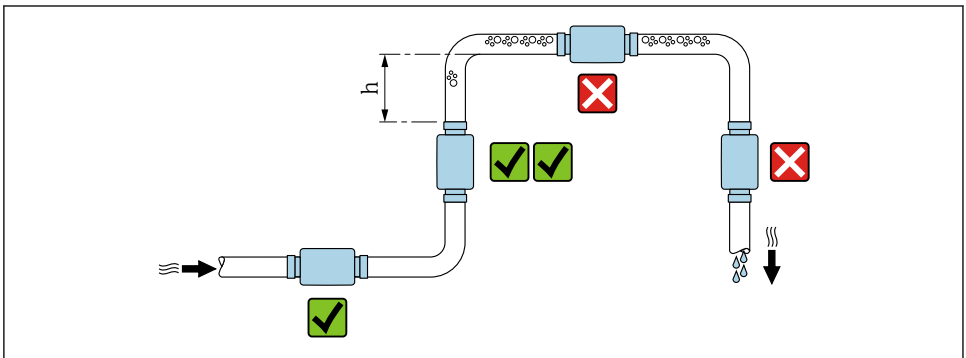
- ▶ Ensure homogeneous mixing of the liquid and its continuous flow to the sensor.

##### Installation location

- Install the sensor in an area that meets the following conditions:
  - Well-mixed medium
  - Bubble-free medium
  - Constantly heated medium, not close to heating coils
- Support the sensor in the event of severe dynamic load. Maximum lateral loading capacity: 75 Nm (55 lbf ft).
- Allow sufficient space for mounting and electrical connection.

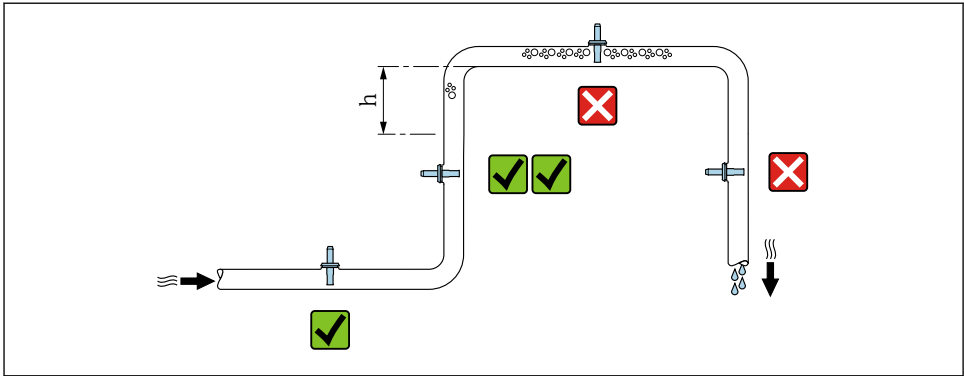
##### Piping

- Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow:  $h \geq 5 \times \text{DN}$ .
- Do not install the device at the highest point of the pipe.
- Do not install the device upstream from a free pipe outlet in a down pipe.



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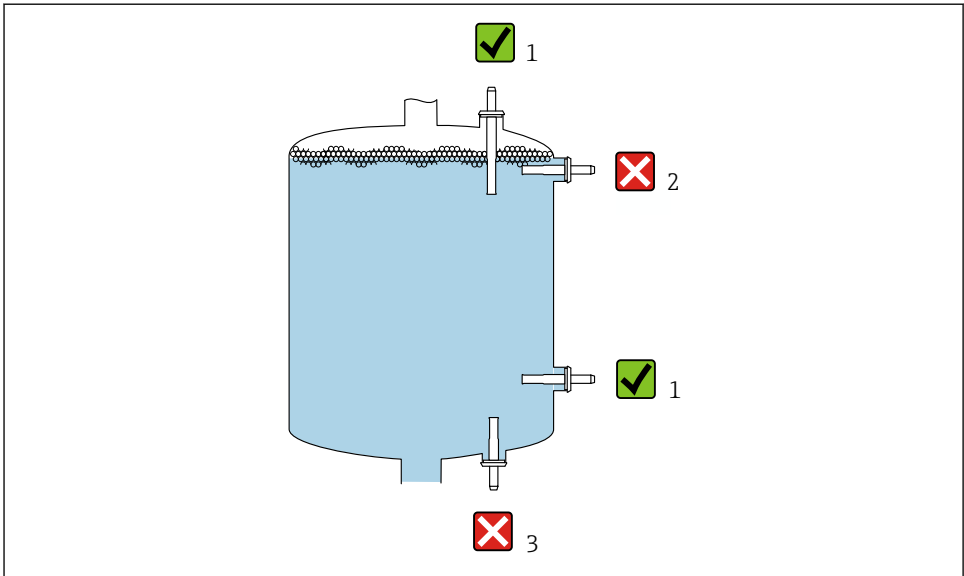
3 Installation location, inline measuring instrument



A0060219

4 Installation location, insertion measuring instrument

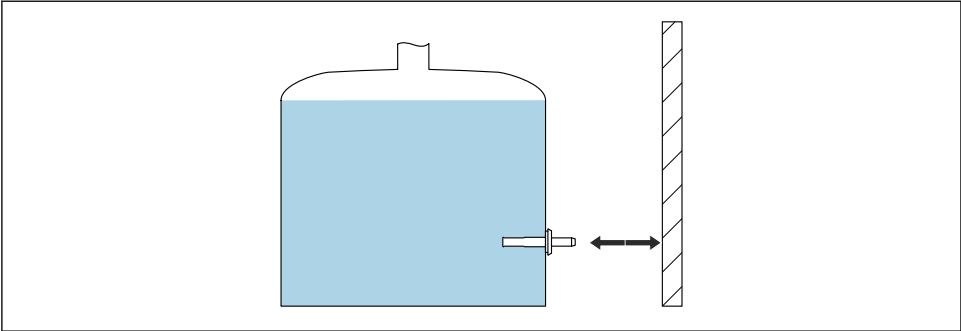
Tank



A0060238

5 Tank installation location, insertion measuring instrument

- 1 Select the installation location such that the sensor opening is completely immersed in the medium.
- 2 Avoid the installation location at the filling limit, as this can lead to increased bubble formation.
- 3 Avoid the installation location at the tank bottom in hygienic applications or if sedimentation is to be expected.



A0060239

6 Take into consideration the spacing, insertion measuring instrument

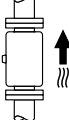
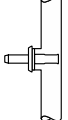
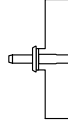
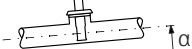
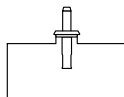
Orientation

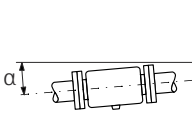
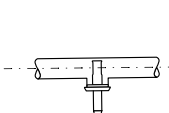
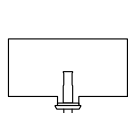
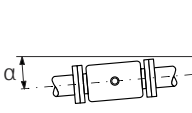
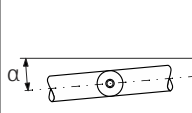
NOTICE

Self-drainability must be ensured for hygienic applications and applications with sediment formation.

- Select the installation position and angle so that, during draining, the medium can drain completely by gravity and no residue remains on the sensor.

For the insertion sensor in tanks: To ensure hygienic installation, position the sensor such that all surfaces are directly reachable by spray from a cleaning device.

| Orientation                                           |                                                                                                                 |                                                                                                                 |                                                                                                                 |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
|                                                       | Inline sensor                                                                                                   | Insertion sensor, pipe installation                                                                             | Insertion sensor, tank installation                                                                             |
| Vertical orientation                                  | <br>A0060225 ✓✓               | <br>A0060229 ✓✓ <sup>1)</sup> | <br>A0060390 ✓✓ <sup>1)</sup> |
| Horizontal orientation<br>Push-pull connection at top | <br>A0060226 ✓ <sup>2)</sup> | <br>A0060230 ✓ <sup>1)</sup> | <br>A0060391 ✓               |

| Orientation                                                 |                                                                                                           |                                                                                                           |                                                                                                           |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
|                                                             | Inline sensor                                                                                             | Insertion sensor,<br>pipe installation                                                                    | Insertion sensor,<br>tank installation                                                                    |
| Horizontal orientation,<br>Push-pull connection at bottom   | <div><br/>A0060227</div> | <div><br/>A0060231</div> | <div><br/>A0060392</div> |
| Horizontal orientation,<br>Push-pull connection on the side | <div><br/>A0060228</div> | <div><br/>A0060232</div> | —                                                                                                         |

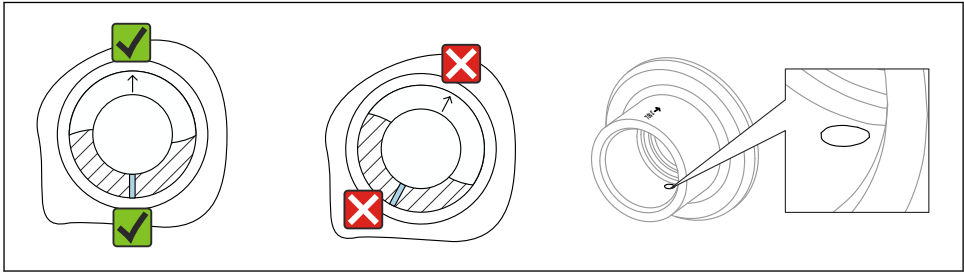
- 1) In hygienic applications and media that tend to cause buildup, install the insertion sensor with an inclination angle of  $\geq 3^\circ$ , so that no dead legs can form in which the medium can remain. Ensure that the medium can drain completely and that no residue remains on the sensor, weld-in adapter or T-piece.
- 2) The measuring instrument should be self-draining for hygiene applications. A vertical orientation is recommended for this. If only a horizontal orientation is possible, an angle of inclination  $\alpha \geq 3^\circ$  is recommended.
- 3) This orientation is not suitable in hygienic applications or media that tend to form buildup. Install the insertion sensor such that no dead space is created in which the medium can remain. Ensure that the medium can drain completely and that no residue remains on the sensor, weld-in adapter or T-piece.
- 4) This orientation is not suitable for media that tend to form buildup on the bearing surface and can thereby affect the measurement result.

Process connections

Installation conditions for weld-in adapter

-  For detailed information, see "Technical Information" TI00426F (weld-in adapters, process adapters and flanges).
- For process connection version G1", there is a weld-in adapter as an accessory, .

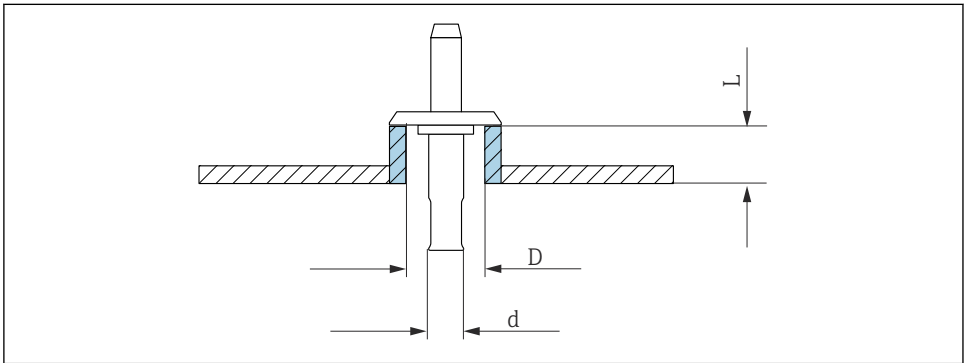
Weld in the weld-in adapter in such a way that the leakage hole is pointing downwards. This enables any leaks to be detected more quickly.



A0060462

### Installation conditions for T-piece installation

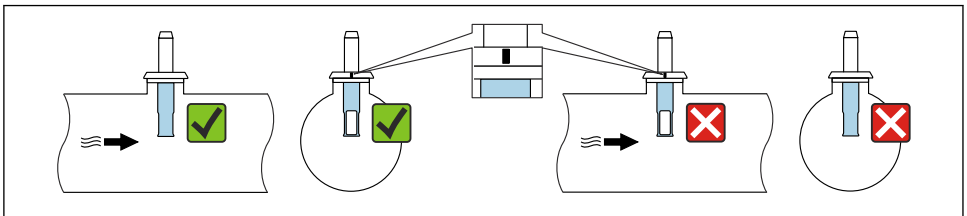
- The sensor opening must be completely wetted with the medium.
- To ensure hygienic installation the dead end of the T-piece should be minimized. See also the "Certificates and approvals/hygienic compatibility" section .  
The ratio between the depth of the T-piece (L), diameter D of the T-piece and diameter d of the sensor must comply with:
  - For EHEDG:  $L/(D-d) < 1$
  - For 3-A:  $L/(D-d) < 2$
- T-piece length:
  - For pipe installation a T-piece with a length of  $L = 15 \text{ mm}$  must be used.
  - For tank installation a T-piece with a length of  $L \leq 25 \text{ mm}$  must be used.



A0060470

### Orientation of the insertion sensor

- If installing in a tank in a horizontal position, the marking on the process connection must point up or down to avoid buildup in the area of the sensor.
- If installing in a pipe, the marking on the process connection must point in the flow direction so that the flow is guided through the sensor opening.

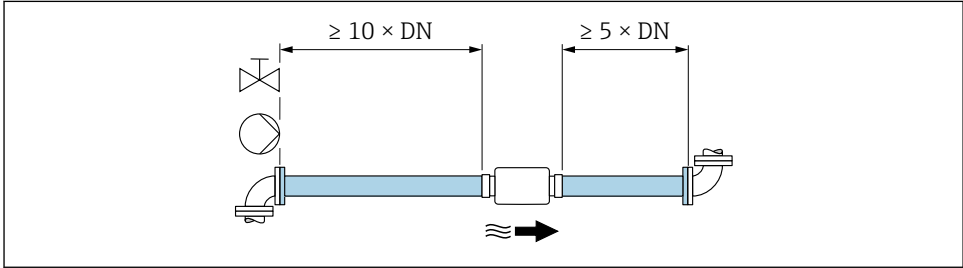


A0060461

- 7 Align the sensor in the pipe so that there is sufficient flow through the sensor opening and the flow is not significantly impeded. Align the marking on the process connection in the direction of flow for this purpose.

## Inlet and outlet runs

Observe the following inlet and outlet runs to comply with accuracy specifications:



A0035458

8 Inlet and outlet runs

### 4.1.2 Environmental and process requirements

#### Ambient temperature range

 For detailed information on the ambient temperature range, see the Operating Instructions for the device.

If operating outdoors:

- Install the sensor in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid rain, condensation and ice formation.
- Avoid direct exposure to weather conditions.
- The transmitter is not designed for operation outdoors.

#### Vibrations

Installation in event of pipe vibrations

#### NOTICE

**Pipe vibrations can damage the device!**

- ▶ Do not expose the device to strong vibrations.
- ▶ Support the pipe and fix it in place.
- ▶ Support the device and fix it in place.

## 4.2 Installing the device

### 4.2.1 Installing the inline sensor

#### WARNING

**Excessive equipotential bonding current between the transmitter and sensor can cause overheating and fire, and impair measurement.**

- ▶ Connect the sensor to the ground wire via the piping system.
- ▶ For sensors with a Tri-Clamp connection, only use stainless steel clamps to ensure the electrical connection to the piping system.



**⚠ WARNING****Danger due to improper process sealing!**

- ▶ Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- ▶ Ensure that the seals and sealing surfaces are clean and undamaged.
- ▶ Use only the process connections, seals, and Endress+Hauser accessories supplied.
- ▶ Secure the seals correctly.

**⚠ WARNING****Incorrect installation or contaminated connection parts can cause liquid to escape uncontrollably in the event of a seal defect.**

- ▶ Keep all connection parts clean.
- ▶ Position the leakage groove in the process connection pointing downward so that liquid can be dissipated specifically.

**Mounting the sensor with the threaded adapter in the pipe**

- ▶ Mount the sensor in the pipe in full compliance with the installation conditions → 📄 11.

**Welding the sensor with the welding socket into the pipe**

1. Tack-weld the process connection to secure it in the pipe.
2. Release the screws on the process connections and remove the sensor, along with the seal, from the pipe.
3. Weld the process connection into the pipe.
4. Mount the sensor, along with the seals, back on the process connections. Ensure that all the connection parts are clean and the leakage groove on the process connection is located on the underside of the transmitter.
5. Check whether the process connections and seals are centered when mounted.
6. Tighten the screws in a diagonally opposite sequence with a torque of 7 Nm (5.2 lbf ft).

**4.2.2 Installing the insertion sensor****⚠ WARNING****Excessive equipotential bonding current between the transmitter and sensor can cause overheating and fire, and impair measurement.**

- ▶ Connect the sensor to the ground wire via the piping system.
- ▶ For sensors with a Tri-Clamp connection, only use stainless steel clamps to ensure the electrical connection to the piping system.

## ⚠ WARNING

### **Danger due to improper process sealing!**

- ▶ Match the seals to the type and nominal diameter of the process connection.
- ▶ Select the seal material as per the process parameters (such as temperature, pressure, medium, cleaning agent).
- ▶ For the insertion sensor with an ISO228, 1" thread, only use the process connections, seals and Endress+Hauser accessories supplied.
- ▶ Ensure that the seals and sealing surfaces are clean and undamaged.
- ▶ Secure the seals correctly.

### **Installing the insertion sensor with dairy, Tri-Clamp and Varivent connections**

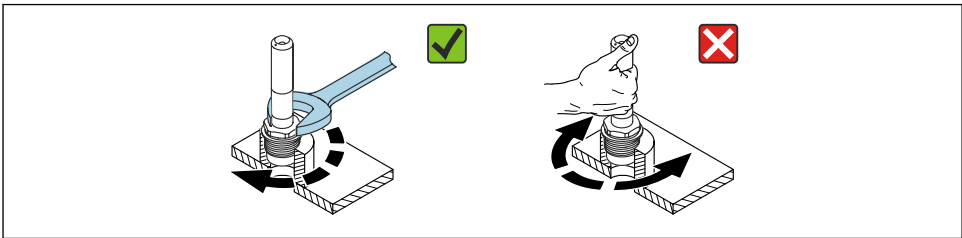
1. Insert the sensor with the seal correctly positioned.
2. Tighten the clamping connection evenly.

### **Insertion sensor with ISO228, 1" thread**

- ▶ Screw the sensor with the correctly positioned seal into the process connection or weld-in adapter.

Note the following when screwing in the sensor:

- Only turn by the hexagon, 15 to 30 Nm (11 to 22 lbf ft).
- Do not turn at the housing.



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## **4.2.3 Mounting the transmitter**

### **Transmitter with aluminum housing**

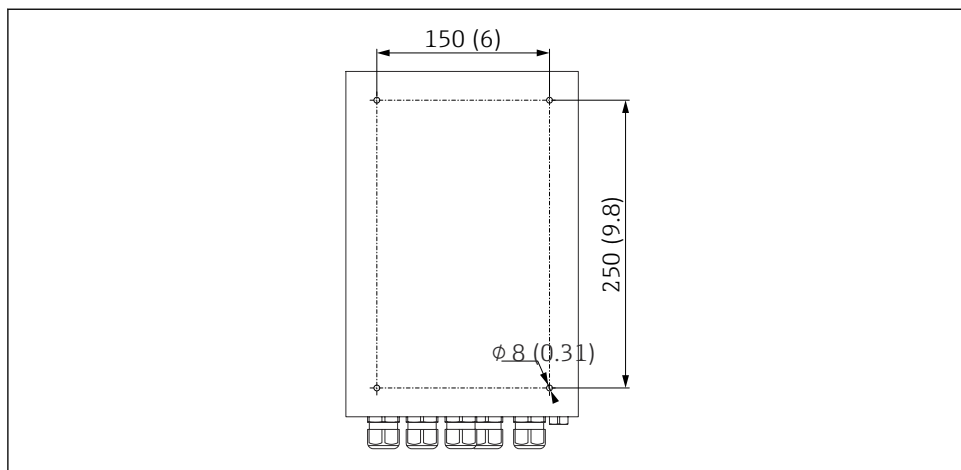
- ▶ Mount the transmitter on the DIN rail DIN EN 60715 TH 35 using the DIN rail holder.

### **Transmitter with stainless steel housing**

The transmitter can be mounted in the following ways:

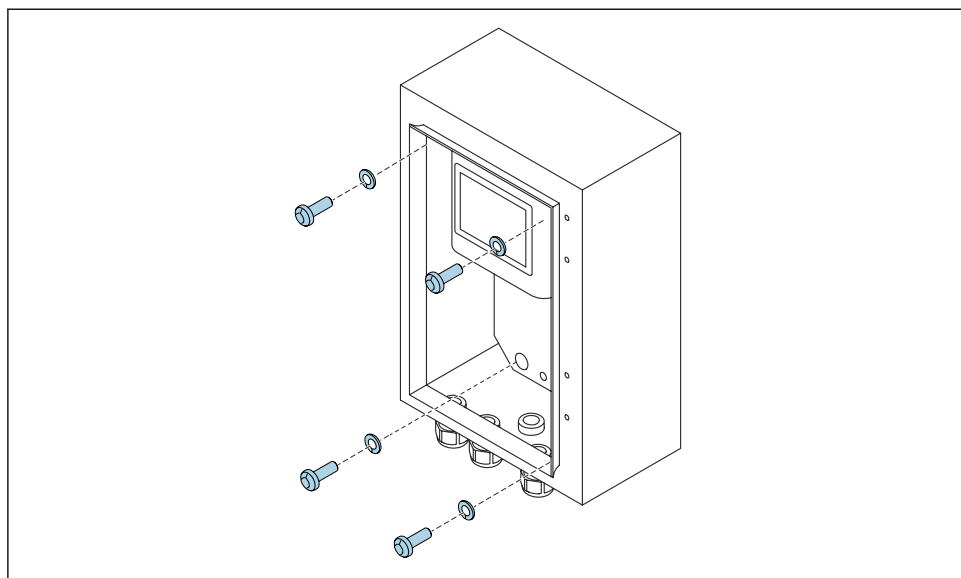
- Wall mounting: Mounting over the mounting holes
- Post mounting: Mounting with transmitter holder (accessory)

### Preparing for mounting



A0061031

#### 9 Mounting holes, engineering unit mm (in)



A0062011

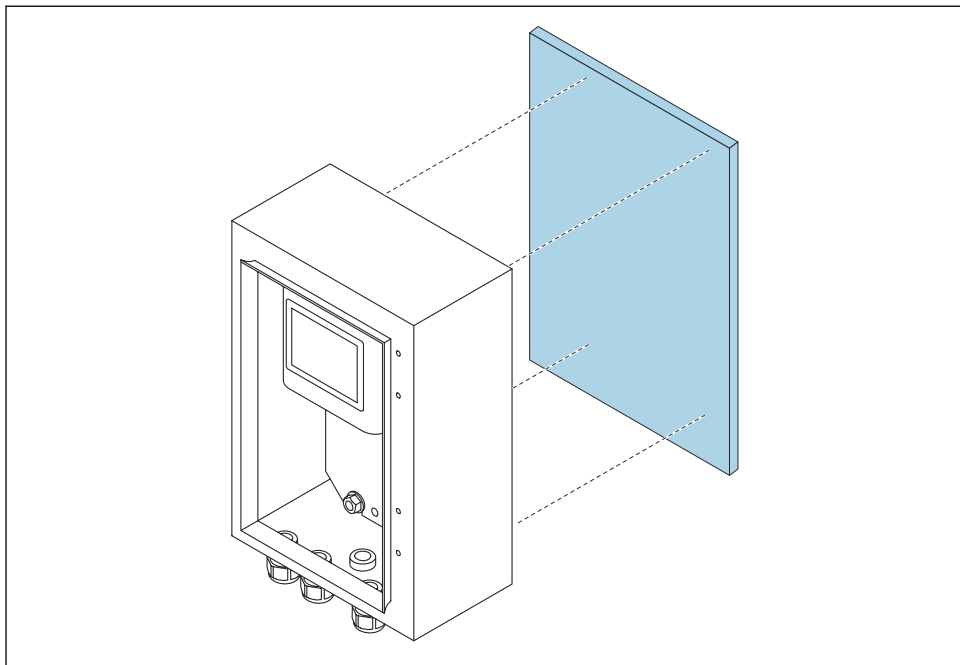
#### 10 Carry out M8 screws with copper washers through the mounting bores from the inside.

1. Prepare the wall or bracket based on the dimensions of the mounting bores.
2. Open the housing cover.

3. Guide four M8 screws with copper washers from the inside of the housing through the mounting bores provided.

### *Securing the transmitter*

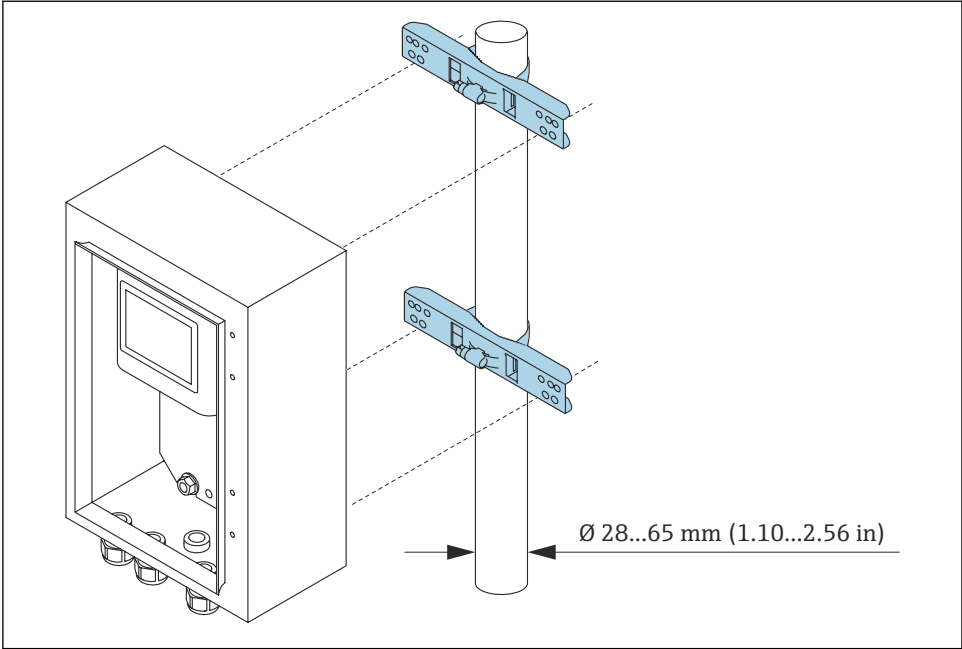
#### *Wall mounting*



A0061959

- Secure the transmitter to the wall with the screws previously used and tighten to 18 Nm (13.2 lbf ft).

Post mounting



A0061032

1.

Secure the transmitter holder to a post with the clamps and tighten to 1.6 Nm (1.18 lbf ft).
2.

Secure the transmitter to the transmitter holder with the screws previously used and tighten to 18 Nm (13.2 lbf ft).

4.3 Post-installation check

|                                                                                                                                                                                                                            |                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Is the device undamaged (visual inspection)?                                                                                                                                                                               | <input type="checkbox"/> |
| Does the measuring instrument correspond to the measuring point specifications?<br>For example: <ul style="list-style-type: none"><li>■ Ambient temperature</li><li>■ Nominal pressure</li><li>■ Measuring range</li></ul> | <input type="checkbox"/> |
| Correct installation location and alignment of sensor selected? → 11                                                                                                                                                       | <input type="checkbox"/> |
| Have the correct seals and process connections been selected and the process sealing been ensured?                                                                                                                         | <input type="checkbox"/> |
| Are the specifications for the inlet run observed (inlet run ≥ 10 × DN)?                                                                                                                                                   | <input type="checkbox"/> |
| Are the specifications for the outlet run observed (outlet run ≥ 5 × DN)?                                                                                                                                                  | <input type="checkbox"/> |
| Is the device sufficiently protected from precipitation and direct sunlight?                                                                                                                                               | <input type="checkbox"/> |

## 5 Electrical connection

 The measuring instrument does not have an internal circuit breaker. For this reason, assign the measuring instrument a switch or power-circuit breaker that allows the power supply line to be easily disconnected from the mains.

### 5.1 Connecting requirements

#### 5.1.1 Requirements for connecting cable

The connecting cables provided by the customer must fulfill the following requirements.

#### Electrical safety

In accordance with applicable national regulations.

#### Connecting cable between the sensor and transmitter

Only use the cable supplied.

#### Permitted temperature range

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.
- A temperature increase of up to +20K above the ambient temperature must be expected in stainless steel housings.

#### Protective ground for protective ground terminal

##### *Transmitter with aluminum housing*

|                         |                                              |
|-------------------------|----------------------------------------------|
| Conductor cross-section | 0.129 to 1.31 mm <sup>2</sup> (16 to 26 AWG) |
| Grounding impedance     | < 2 Ω                                        |

##### *Transmitter with stainless steel housing*

|                     |                                      |
|---------------------|--------------------------------------|
| Connection type     | Via cable lug, suitable for M6 bolts |
| Grounding impedance | < 2 Ω                                |
| Cable diameter      | 4 to 6.5 mm (0.16 to 0.25 in)        |

#### Modbus Ethernet cable

|                |                                              |
|----------------|----------------------------------------------|
| Cable type     | 100 Base-TX                                  |
| Cable category | Min. CAT5                                    |
| Plug type      | RJ-45 (8P8C)                                 |
| Shielding      | S/FTP, F/FTP, SF/FTP, S/UTP, F/UTP or SF/UTP |

|                |                               |
|----------------|-------------------------------|
| Cable length   | Max. 30 m (98 ft)             |
| Cable diameter | 4 to 6.5 mm (0.16 to 0.25 in) |

Power supply and signal cables

|                         |                                              |
|-------------------------|----------------------------------------------|
| Cable type              | Strand or solid wire                         |
| Conductor cross-section | 0.129 to 1.31 mm <sup>2</sup> (16 to 26 AWG) |
| Cable length            | Max. 30 m (98 ft)                            |
| Cable diameter          | 7 to 10 mm (0.28 to 0.39 in)                 |
| Power supply cable      | Standard installation cable is sufficient.   |
| Analog output           | Standard installation cable is sufficient.   |
| Digital input           | Standard installation cable is sufficient.   |
| Switch output (alarm)   | Standard installation cable is sufficient.   |

5.1.2 Terminal assignment

| Terminal                                                                            | Assignment                              | Description          |
|-------------------------------------------------------------------------------------|-----------------------------------------|----------------------|
| V+                                                                                  | <b>V<sub>in</sub></b><br>DC 24 V        | Supply voltage       |
| V-                                                                                  |                                         |                      |
| +                                                                                   | <b>out</b><br>0 to 10 V; 4 to 20 mA     | Analog output        |
| -                                                                                   |                                         |                      |
| 0                                                                                   | <b>output</b><br>selection              | Digital input        |
| 1                                                                                   |                                         | Digital input ground |
|  |                                         |                      |
|  | <b>alarm</b><br>Max. 50 VDC/30 VAC, 1 A | Switch output        |
|  |                                         |                      |

5.1.3 Requirements for the supply unit

|                      |                                                                                                                    |
|----------------------|--------------------------------------------------------------------------------------------------------------------|
| Supply voltage       | DC 19.2 to 28.8 V                                                                                                  |
| Version              | Touch-safe circuit according to EN 61010-1, as terminal V- is electrically connected to the transmitter housing.   |
| Power unit           | The power unit must be safety-approved (PELV), as the measuring instrument is Class III equipment.                 |
| Overvoltage category | The measuring instrument is designed for operation on the secondary side of power units in overvoltage category I. |

## 5.2 Connecting the device: Transmitter with aluminum housing

### WARNING

#### Live parts.

Incorrect work performed on the electrical connections can result in an electric shock.

- ▶ Only properly trained specialist staff may perform electrical connection work.
- ▶ Refer to applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.

### 5.2.1 Connecting the signal and supply voltage cables

1. Connect the protective ground to terminal V-, ensure potential equalization →  25, terminal assignment →  23.
2. Ground the transmitter housing via the mounted DIN rail.
3. Connect the signal and supply voltage cables to the transmitter via screw terminals, terminal assignment →  23.
4. For transmission via Modbus protocol or connection to the "Tegwave Viewer" operating tool, connect the Ethernet cable to the Ethernet port of the transmitter and the Ethernet port of the computer or network. To establish the connection to the operating tool, see the Operating Instructions for the device.

### 5.2.2 Connecting the connecting cable

Connect the sensor to the transmitter only using the connecting cable supplied. This is important because the cable length influences the measuring signal and is taken into account in the calibration.

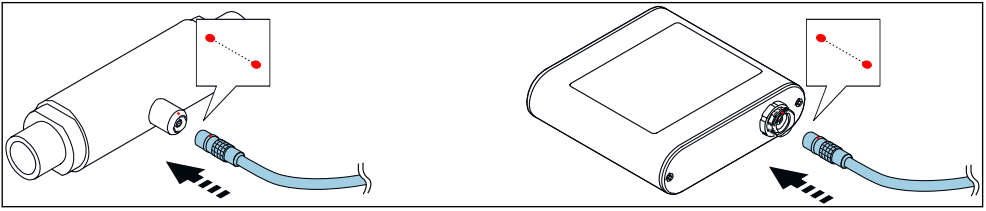
### NOTICE

#### Measuring instrument malfunction

Damaged cables can impact the functional integrity of the measuring instrument.

- ▶ Do not route the connecting cables along the piping system as the maximum permitted temperature can be exceeded.
- ▶ Avoid strain when laying the connecting cable.
- ▶ Do not bend or shorten the connecting cable.
- ▶ Do not remove the plug of the connecting cable.
- ▶ Replace damaged or broken cables immediately.
- ▶ Route connecting cables separate from cables that carry very large electrical current (e.g. converter and motor connecting cables).





11 Connecting the connecting cable



Red dots on the connectors indicate the position.

- ▶ Insert the push-pull connectors of the connecting cable into the sockets at the position indicated until they engage with a click.

### 5.2.3 Ensuring potential equalization

Due to their function, sensors and transmitters are connected via a common ground potential. Potential equalization currents can be avoided with the following measures.

#### **⚠ WARNING**

**Excessive equipotential bonding current between the transmitter and sensor can cause overheating and fire, and impair measurement.**

- ▶ Connect the sensor to the ground wire via the piping system.

#### Checking the protective ground connection

- ▶ Ensure that the protective ground is connected to terminal V- of the transmitter.

#### Checking for the absence of current

1. Unplug the connecting cable from the sensor and leave it attached to the transmitter.
2. Measure the absence of current between the grounding point of the sensor and the unplugged metal plug of the cable (cable shield).

## 5.3 Connecting the device: Transmitter with stainless steel housing

#### **⚠ WARNING**

##### Live parts.

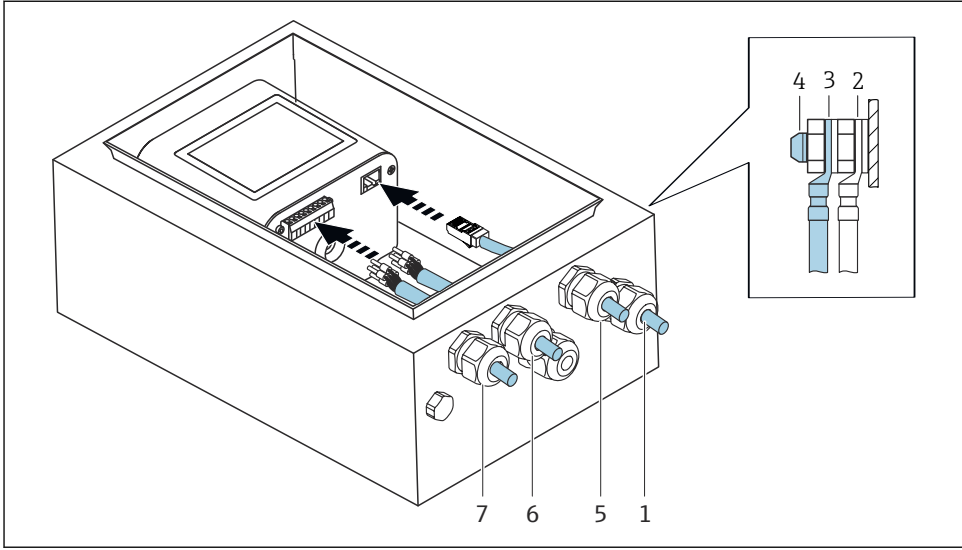
Incorrect work performed on the electrical connections can result in an electric shock.

- ▶ Only properly trained specialist staff may perform electrical connection work.
- ▶ Refer to applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.

### 5.3.1 Opening the housing cover

- ▶ Open the housing cover using the control cabinet key.

### 5.3.2 Connecting the signal and supply voltage cables



A0060065

#### NOTICE

**The degree of protection is guaranteed only when the seals are mounted correctly**

- Cable glands (1) and (5): Equipped with slotted seal. Prior to installation, insert the seal over the cable and mount it together with the cable.
- Cable glands (6) and (7): Equipped with sealing rings. Do not remove the sealing rings.

#### NOTICE

**Missing or insufficient grounding may impair functionality and lead to incorrect measurement results**

- Properly ground the measurement device.

1. Guide the protective grounding cable through the cable gland (1) and connect it to the pre-installed internal grounding (2) on the M6 bolt (4) inside the housing using a cable lug (3). Prior to installation, insert the slotted seal over the cable and mount it together with the cable in the cable gland in order to ensure that there are no leaks.
2. If necessary, guide the Ethernet cable through the cable gland (5). Prior to installation, insert the slotted seal over the cable and mount it together with the cable in the cable gland in order to ensure that there are no leaks.
3. Feed the signal and supply voltage cables through the cable glands (6) and (7). To ensure tight sealing, do not remove the sealing rings from the cable glands.
4. Connect the signal and supply voltage cables to the transmitter via screw terminals, terminal assignment →  23.

5. For transmission via Modbus protocol or connection to the "Tegwave Viewer" operating tool, connect the Ethernet cable to the Ethernet port of the transmitter and the Ethernet port of the computer or network. To establish the connection to the operating tool, see the Operating Instructions for the device.
6. Tighten the cable glands to 2.5 Nm (1.84 lbf ft).

### 5.3.3 Connecting the connecting cable

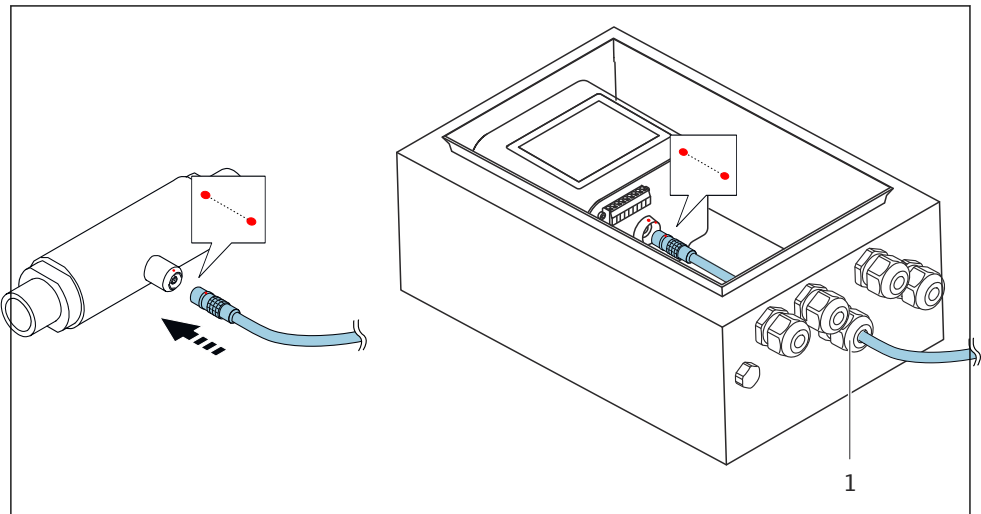
Connect the sensor to the transmitter only using the connecting cable supplied. This is important because the cable length influences the measuring signal and is taken into account in the calibration.

#### NOTICE

##### Measuring instrument malfunction

Damaged cables can impact the functional integrity of the measuring instrument.

- ▶ Avoid strain when laying the connecting cable.
- ▶ Do not bend or shorten the connecting cable.
- ▶ Do not remove the plug of the connecting cable.
- ▶ Replace damaged or broken cables immediately.
- ▶ Route connecting cables separate from cables that carry very large electrical current (e.g. converter and motor connecting cables).



Red dots on the connectors indicate the position.

**NOTICE**

**The degree of protection is guaranteed only when the seals are mounted correctly**

- Cable glands (1): Equipped with slotted seal. Prior to installation, insert the seal over the cable and mount it together with the cable.

1. Push the connecting cable through the cable gland (1). Prior to installation, insert the slotted seal over the cable and mount it together with the cable in the cable gland in order to ensure that there are no leaks.
2. Insert the push-pull connectors of the connecting cable into the sockets at the position indicated until they engage with a click. Red dots on the connectors indicate the position.
3. Tighten the cable glands to 2.5 Nm (1.84 lbf ft).

### 5.3.4 Ensuring potential equalization

Due to their function, sensors and transmitters are connected via a common ground potential. Potential equalization currents can be avoided with the following measures.

**⚠ WARNING**

**Excessive equipotential bonding current between the transmitter and sensor can cause overheating and fire, and impair measurement.**

- Connect the sensor to the ground wire via the piping system.

### Checking the protective ground connection

- Ensure that the protective ground is connected to terminal V- of the transmitter.

### Checking for the absence of current

1. Unplug the connecting cable from the sensor and leave it attached to the transmitter.
2. Measure the absence of current between the grounding point of the sensor and the unplugged metal plug of the cable (cable shield).

### 5.3.5 Closing the housing cover

- Close the housing cover using the control cabinet key.

### 5.3.6 Ensuring the degree of protection

#### Degree of protection: IP66

The transmitter with stainless steel housing fulfills all the requirements for the degree of protection IP66.

To ensure degree of protection IP66, carry out the following steps after making the electrical connection:

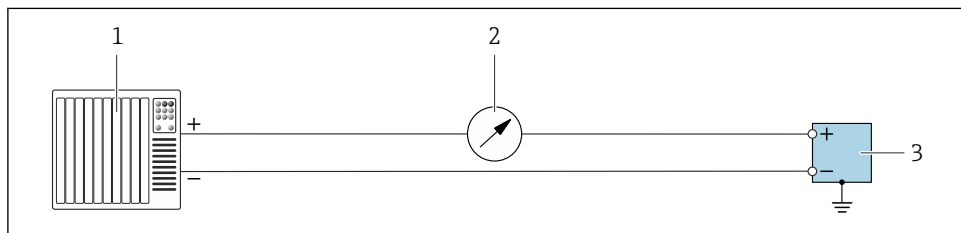
1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.
3. Tighten all housing screws and screw covers.

4. Tighten the cable glands to 2.5 Nm (1.84 lbf ft).
5. Unused cable glands must be closed with the dummy plugs supplied to guarantee the degree of protection of the transmitter.

## 5.4 Special connection instructions

### 5.4.1 Connection examples

#### Current output 4 to 20 mA (without HART)

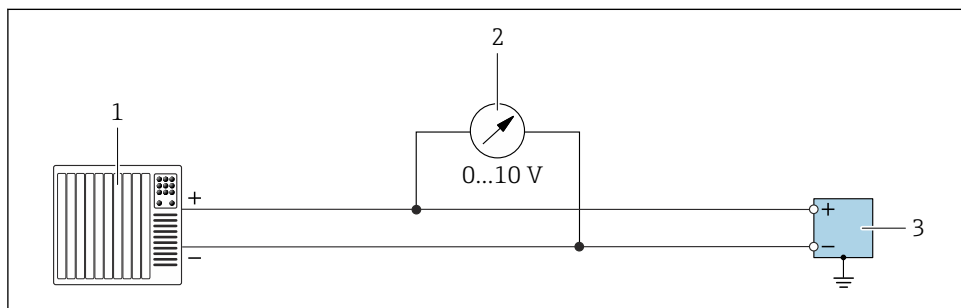


A0055851

12 Connection example for 4 to 20 mA current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Optional additional display unit: Observe maximum load
- 3 Transmitter with current output (active)

#### Voltage output 0 to 10 V

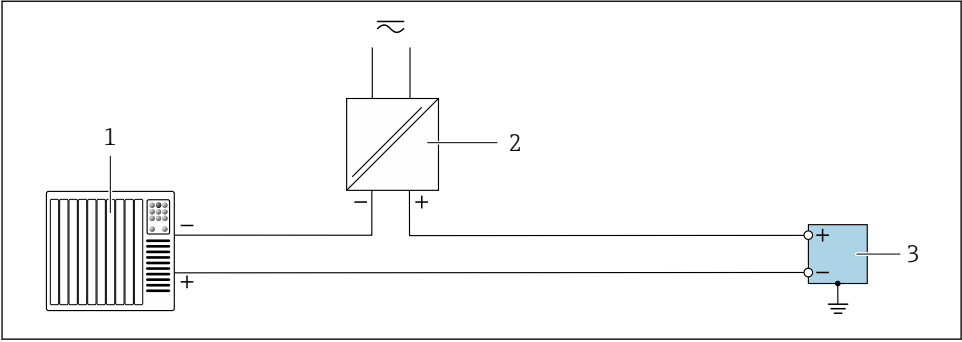


A0056212

13 Connection example for voltage output, active, 0 to 10 V

- 1 Automation system with voltage input (e.g. PLC)
- 2 Analog display unit for voltage: Observe minimum load
- 3 Transmitter with voltage output

Relay output



A0055859

14 Connection example for relay output

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter with relay output

Digital input (elective inputs)

The digital input controls which measured variable is active at the analog output. A total of up to four measured variables can be configured.

Configuration options:

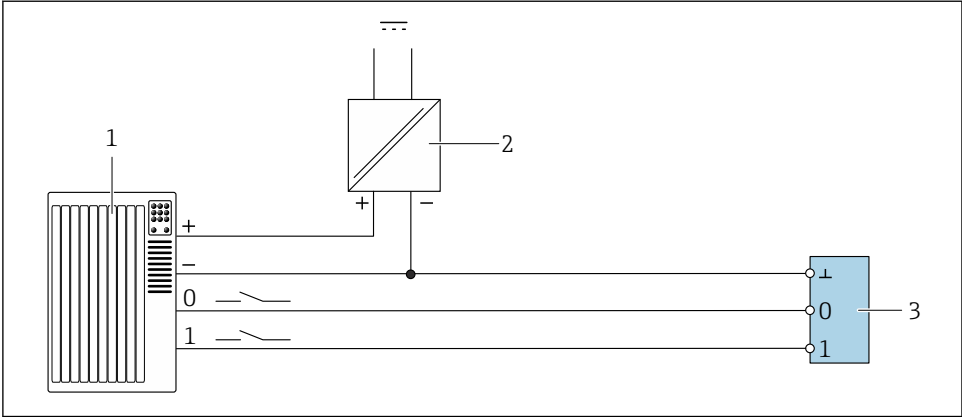
| Active analog output | Digital input "0"               | Digital input "1"               |
|----------------------|---------------------------------|---------------------------------|
| Channel 1            | Open                            | Open                            |
| Channel 2            | Ground (digital input $\perp$ ) | Open                            |
| Channel 3            | Open                            | Ground (digital input $\perp$ ) |
| Channel 4            | Ground (digital input $\perp$ ) | Ground (digital input $\perp$ ) |

NOTICE

Interference at the digital input

If the measuring instrument is connected incorrectly, this can impact the functional integrity of the device.

- Switch the digital input only against the digital input ground ( $\perp$ ).



A0035462

15 Connection example for the digital input

- 1 Automation system with switch output (e.g. PLC)
- 2 Power supply
- 3 Transmitter

**i** If the transmitter is connected as illustrated in the example, the outputs are no longer galvanically isolated.

5.5 Post-connection check

|                                                                                                                                                                                                                             |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Are the device and cable undamaged (visual inspection)?                                                                                                                                                                     | <input type="checkbox"/> |
| Do the cables used meet the requirements→ 22?                                                                                                                                                                               | <input type="checkbox"/> |
| Are the mounted cables strain relieved?                                                                                                                                                                                     | <input type="checkbox"/> |
| Are all the connectors firmly seated?                                                                                                                                                                                       | <input type="checkbox"/> |
| Is the terminal assignment correct?                                                                                                                                                                                         | <input type="checkbox"/> |
| Are all the screw terminals firmly tightened?                                                                                                                                                                               | <input type="checkbox"/> |
| Is terminal V- connected to the protective earth?                                                                                                                                                                           | <input type="checkbox"/> |
| Has the protective earthing of the transmitter housing been established correctly?                                                                                                                                          | <input type="checkbox"/> |
| Is the potential equalization between the transmitter and sensor correctly established?                                                                                                                                     | <input type="checkbox"/> |
| For a transmitter with stainless steel housing: <ul style="list-style-type: none"><li>Are dummy plugs inserted in unused cable glands?</li><li>Are all cable glands installed, securely tightened and leak-tight?</li></ul> | <input type="checkbox"/> |
| If supply voltage is present:<br>Is the device operational and do values appear on the display module?                                                                                                                      | <input type="checkbox"/> |

## 6 Operation options

### 6.1 Overview of the operation options

The measuring device can be operated in the following ways:

- Operation via the local display (transmitter with touch screen)
- Operation via the "Teqwave Viewer" operating tool supplied

### 6.2 Access to the measuring instrument via the local display

The device can be operated via the transmitter touchscreen and via the "Teqwave Viewer" operating tool.

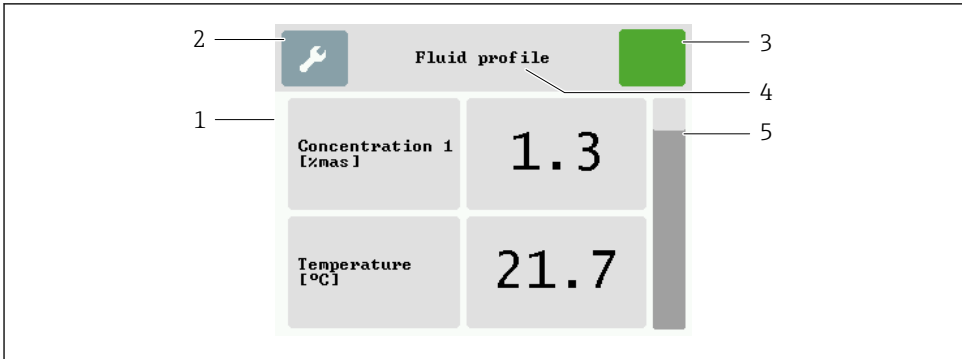
 For the transmitter with a stainless steel housing, the housing cover must be opened to gain access to the touchscreen.

**Functions supported when operating via the transmitter:**

- Real-time display of the measured values in list and graph formats
- Selection of a fluid profile or a recipe
- Device configurations

#### 6.2.1 Transmitter operational display

The operational display is used to view the measured values and the sensor status, and use the touchscreen to access the Settings menu.



A0062014

 16 Operational display

- 1 Measured value display
- 2 Settings menu
- 3 Status indicator
- 4 Name of the fluid profile or the recipe
- 5 Scroll bar



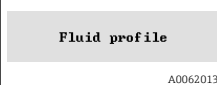
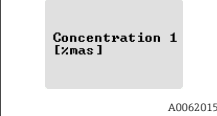
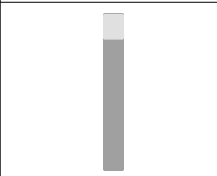
## Measured value display

The list display shows exactly one active measured variable in each line. The display shows the name of the measured variable, its physical unit and the associated measured value.

There are three display modes available in the list display. Two, four or five measured values are displayed simultaneously depending on the mode. If more measured values are available than can be displayed in the selected display mode, the other measured variables can be viewed via the scroll bar on the right edge. When a measured variable is selected, the menu for offset configuration of the active fluid profile or recipe is changed.

In addition, a display mode is available in which a single measured value is displayed in the form of a graph. The list and graph format and can be changed with the **View** parameter, see → 40.

## Functions of the display and operating elements

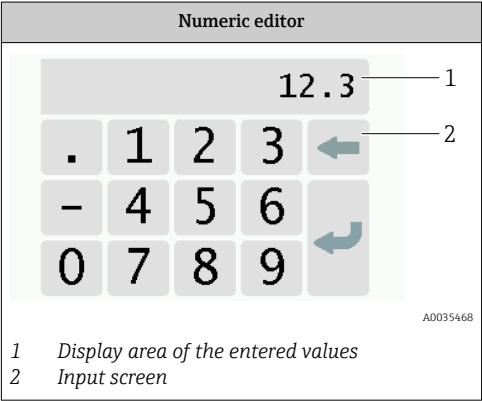
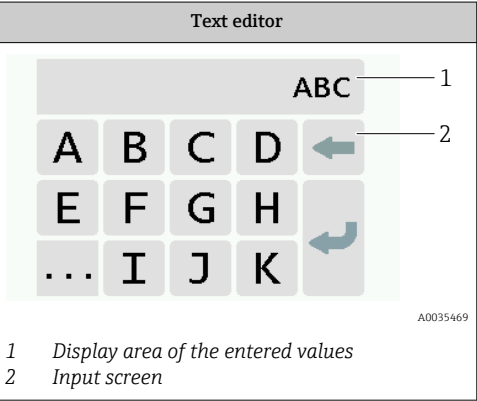
| Button                                                                              | Description                                                                                                                 |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|    | <b>Settings menu</b><br>Opens the settings.                                                                                 |
|    | <b>Navigation</b><br>Navigate between the menus or submenus.                                                                |
|    | <b>Status indicator</b><br>Displays the current status, and navigation to more detailed diagnostic messages in text format. |
|   | <b>Fluid profile name</b><br>Displays the name of the fluid profile and navigation to the operational display.              |
|  | <b>Measured variable display</b><br>Displays the measured variable and its unit, and navigation to the offset setting.      |
|  | <b>Measured value display</b><br>Displays the measured value and navigation to the offset setting.                          |
|  | <b>Scroll bar</b><br>For scrolling up and down.                                                                             |

States of functions and parameters

Tap a parameter or function to open the related submenu or to activate a function.

| Button  | Description                                                              |
|---------|--------------------------------------------------------------------------|
| Deutsch | Blue background<br>Parameter is selected or function is activated.       |
| English | Gray background<br>Parameter is not selected or function is deactivated. |

Editing elements

| Numeric editor                                                                                                                                  | Text editor                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>1 Display area of the entered values<br/>2 Input screen</p> |  <p>1 Display area of the entered values<br/>2 Input screen</p> |

Input screen

The following input symbols are available in the input screen of the numeric and text editor:

Input and operating symbols in the editors

| Symbol  | Meaning                                                  |
|---------|----------------------------------------------------------|
| A ... Z | Selection of letters from A to Z.                        |
| 0 ... 9 | Selection of numbers from 0 to 9 and special characters. |
| .       | Inserts decimal separator at the cursor position.        |
| -       | Inserts minus sign at the cursor position.               |

| Symbol                                                                            | Meaning                            |
|-----------------------------------------------------------------------------------|------------------------------------|
|  | Confirms selection.                |
|  | Clears the last character entered. |

## 6.3 Access to the measuring instrument via the operating tool

 For detailed information on access to the measuring instrument, see the Operating Instructions for the device.

# 7 Commissioning

## NOTICE

### Damage to the touchscreen

Sharp objects, electrostatic discharge, water and the use of pens not designed for touchscreens, such as standard pencils, can cause a malfunction of the transmitter or damage the touch screen.

- ▶ Do not use sharp objects to operate the touchscreen.
- ▶ To avoid electrostatic discharge, make sure the touchscreen does not come into contact with other devices.
- ▶ Make sure the touch screen does not come into contact with water.
- ▶ Only use your finger or a specially designed stylus pen to operate the touchscreen.

## 7.1 Post-installation and post-connection check

Before commissioning the device:

- ▶ Make sure that the post-installation and post-connection checks have been performed successfully.
- Checklist for "Post-installation" check →  21
- Checklist for "Post-connection" check →  31

## 7.2 Switching on the measuring device

After a successful function check, switch on the measuring device.

After a successful startup, the local display switches automatically from the start screen to the measured value display.

 If nothing appears on the local display or an error message is displayed, perform diagnostics and troubleshooting .

### 7.3      **Configuring the operating language**

The transmitter operating language is configured via the local display.

-  For the transmitter with stainless steel housing, the housing cover must be removed to gain access to the local display.
-  The language of the "Teqwave Viewer" operating tool is selected via the menu "Teqwave Viewer" → "Language settings". The options available correspond to those of the transmitter.

*Navigation on the transmitter*

Settings menu → "Language settings"

-  Once the language has been selected, the operating tool transmits the language setting to the transmitter, where it is saved.

| Parameter        | Procedure                  | Selection/input                                                                                                                 | Factory setting |
|------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Language setting | Tap to select the language | <ul style="list-style-type: none"><li>■ German</li><li>■ English</li><li>■ French</li><li>■ Spanish</li><li>■ Italian</li></ul> | English         |

### 7.4      **Configuring the device**

The device can be configured either via the transmitter or via the "Teqwave Viewer" operating tool.

-  If using areas of application: For information on the fluid profiles contained in the areas of application and the associated measuring ranges, see the "Technical Information" document, "Measuring ranges" section.

#### 7.4.1      **Activating the fluid profile**

A fluid profile is always active. The name of the fluid profile currently active is shown on the transmitter in the operating display. If the displayed fluid profile does not match the fluid profile provided for the application, activate the desired fluid profile.

*Navigation on the transmitter*

Operational display → Fluid profile name

*Navigation via the "Teqwave Viewer" operating tool*

Menu "Teqwave Transmitter" → "Manage fluid profiles/recipes"

-  For detailed information on parameters, see the Operating Instructions for the device.

### 7.4.2 Configuring the measuring unit

All the measured values of a fluid profile are configured via the **Measuring unit** (transmitter) menu or via the **Display settings** ("Teqwave Viewer" operating tool) menu. The desired fluid profile must be active →  36.



- The measured value is automatically converted if the unit is changed.
- The unit of the speed of sound and of Delta cF H2O is set permanently to m/s and cannot be changed.

Navigation on the transmitter

- Settings menu → "Application parameter" → "Measuring unit" → "Analysis parameter 1...n"
- Settings menu → "Application parameter" → "Measuring unit" → "Temperature"
- Settings menu → "Application parameter" → "Measuring unit" → "Density"

Navigation via the "Teqwave Viewer" operating tool

- Menu "Teqwave Transmitter" → "Display settings" → "Analysis parameter 1...n"
- Menu "Teqwave Transmitter" → "View settings" → "Temperature"
- Menu "Teqwave Transmitter" → "View settings" → "Density"



- The operating tool communicates the settings to the transmitter as soon as the **Apply** button is clicked.
- For detailed information on parameters, see the Operating Instructions for the device.

### 7.4.3 Configuring the analog output

The **Application parameters** menu contains the parameters for the configuration of the analog output.

Navigation on the transmitter

1. Settings menu → "Application parameters" → "Analog output" → "Analog channel 1...4"
2. Settings menu → "Application parameters" → "Analog output" → "Current/Voltage"
3. Settings menu → "Application parameters" → "Analog output" → "Output settings"
4. Settings menu → "Application parameters" → "Analog output" → "Output settings" → "Suspend time (s)"
5. Settings menu → "Application parameters" → "Analog output" → "Test signal"

Navigation via the "Teqwave Viewer" operating tool

1. Menu "Teqwave Transmitter" → "Application parameters" → "Analog channel 1...4"
2. Menu "Teqwave Transmitter" → "Application parameters" → "Current/Voltage"
3. Menu "Teqwave Transmitter" → "Application parameters" → "Output settings"
4. Menu "Teqwave Transmitter" → "Application parameters" → "Suspend time"
5. Menu "Teqwave Transmitter" → "Application parameters" → "Test signal"



- The operating tool communicates the settings to the transmitter as soon as the **Apply** button is clicked.
- For detailed information on parameters, see the Operating Instructions for the device.

#### 7.4.4 Displaying calibration ranges

The calibration ranges for the temperature and the concentration and compensation values can be viewed via the **Select fluid profile** menu (transmitter with touch screen). The calibration ranges are also specified on the data sheet of a fluid profile.

Navigation using transmitter with touch screen

- ▶ Settings menu → "Select fluid profile" → "Calibration range" → Select temperature, concentration or compensation value

#### 7.4.5 Configuring the measuring range

The **Measuring range** menu contains parameters for configuring the measuring range.



- The settings configured in this menu also apply for the functions of the analog output, where they define the minimum (0 V/4 mA) and the maximum (10 V/20 mA).
- A valid measuring range must be set for the selected fluid profile to ensure correct operation. For measured variables that are relevant for calibration of the fluid profile (e.g. temperature or concentration), the calibration range is also specified. The measuring instrument takes this calibration range from the fluid profile file. It cannot be modified.

Navigation on the transmitter

1. Settings menu → "Application parameters" → "Measuring range" → "Select measured variable" → "Measuring range Max"
2. Settings menu → "Application parameters" → "Measuring range" → "Select measured variable" → "Measuring range Min"
3. Settings menu → "Application parameters" → "Measuring range" → Select measured variable → "Decimal places"

Navigation via the "Tegwave Viewer" operating tool

1. Menu "Tegwave Transmitter" → "Measuring range" → "Select measured variable" → "Measuring range Max"
2. Menu "Tegwave Transmitter" → "Measuring range" → "Select measured variable" → "Measuring range Min"
3. Menu "Tegwave Transmitter" → "View settings" → "Select measured variable" → "Decimal places"



- The operating tool communicates the settings to the transmitter as soon as the **Apply** button is clicked.
- For detailed information on parameters, see the Operating Instructions for the device.

#### 7.4.6 Configuring the switch output

The **Relay output** menu contains all the parameters for configuring the relay output.

## Navigation on the transmitter

1. Settings menu → "Application parameters" → "Relay output" → "Settings" → "Select measured value" → "Output mode"
2. Settings menu → "Application parameters" → "Relay output" → "Settings" → "Select measured value" → "Switch point Max"/"Switch point Min" or "Switch point"
3. Settings menu → "Application parameters" → "Relay output" → "Settings" → "Hysteresis"
4. Settings menu → "Application parameters" → "Relay output" → "Settings" → "NC contact/NO contact"
5. Settings menu → "Application parameters" → "Relay output" → "Output"

## Navigation via the "Teqwave Viewer" operating tool

1. Menu "Teqwave Transmitter" → "Relay output" → "Select measured variable" → "Output mode"
2. Menu "Teqwave Transmitter" → "Relay output" → "Select measured variable" → "Switch point Max"/"Switch point Min" or "Switch point"
3. Menu "Teqwave Transmitter" → "Relay output" → "Select measured variable" → "Hysteresis"
4. Menu "Teqwave Transmitter" → "Relay output" → "Select measured variable" → "NC contact/NO contact"
5. Menu "Teqwave Transmitter" → "Relay output" → "Output"



- The operating tool communicates the settings to the transmitter as soon as the **Apply** button is clicked.
- For detailed information on parameters, see the Operating Instructions for the device.

### 7.4.7 Specifying the storage interval

The **Read memory** function can be used to retrieve measured data stored in the device memory. It is also possible to save the measured data and physical units to a .csv file. This file can then be imported into a database.



For more information on retrieving measured data, see the Operating Instructions for the device.

A storage interval of 10 to 7 200 s can be defined for data storage. The storage interval refers to the frequency at which the data are saved to the device memory.

There are 2 GB of space available on the internal memory. With a storage interval of 60 s, there is enough space in the memory for approx. 7.5 years.

#### NOTICE

**The available storage space is largely occupied.**

The device displays a warning message when the remaining storage capacity reaches 500 MB. Data logging is stopped automatically if there is a remaining storage capacity of 100 MB. The current remaining memory location can be viewed via the "Free memory space" parameter in the "Application parameters" menu.

- Enable storage by removing existing data to enable data logging.

*Navigation on the transmitter*

Settings menu → "Application parameters" → "Storage interval (s)"

*Navigation via the "Teqwave Viewer" operating tool*

Menu "Teqwave Transmitter" → "Storage interval"



- The operating tool communicates the settings to the transmitter as soon as the **Apply** button is clicked.
- For detailed information on parameters, see the Operating Instructions for the device.

## 7.4.8 Configuring the measured value display

The measured value display is configured via various menus in the transmitter and via the "Teqwave Viewer" operating tool.

*Navigation on the transmitter*

1. Settings menu → "View settings"
2. Settings menu → "View settings" → "View"
3. Settings menu → "Application parameters" → "Averaging" → Select measured variable
4. Settings menu → "Application parameters" → "Averaging" → Select the "Temperature" measured variable → "Kalman filter"

*Navigation via the "Teqwave Viewer" operating tool*

1. Menu "Teqwave Transmitter" → "View settings"
2. Menu "Teqwave Transmitter" → "Averaging" → Select measured variable
3. Menu "Teqwave Transmitter" → "Averaging" → Select the "Temperature" measured variable → "Kalman filter"



- The operating tool communicates the settings to the transmitter as soon as the **Apply** button is clicked.
- For detailed information on parameters, see the Operating Instructions for the device.

## 7.4.9 Configuring the touchscreen

The touchscreen is configured via the local display. The **User settings** menu contains all the parameters for configuring the display.



- For the transmitter with a stainless steel housing, the housing cover must be removed to gain access to the touchscreen.

*Navigation using transmitter with touch screen*

1. Settings menu → "User settings" → "Brightness"
2. Settings menu → "User settings" → "Time settings" → "User time"
3. Settings menu → "User settings" → "Time settings" → "User date"
4. Settings menu → "User settings" → "Screensaver" → "Switched off"
5. Settings menu → "User settings" → "Screensaver" → "Reduce brightness" → "Brightness"



6. Settings menu → "User settings" → "Screensaver" → "Reduce brightness" and "Display turn off" → "Time settings" → "Start after"
7. Settings menu → "User settings" → "Screensaver" → "Reduce brightness" and "Display turn off" → "Time settings" → "Time unit"
8. Settings menu → "User settings" → "Screensaver" → "Reduce brightness" and "Display turn off" → "Lock display"
9. Settings menu → "User settings" → "Screensaver" → "Reduce brightness" and "Display turn off" → "Unlock password"
10. Settings menu → "User settings" → "Password protection" → "Fluid profile"
11. Settings menu → "User settings" → "Password protection" → "Settings"



For detailed information on parameters, see the Operating Instructions for the device.

#### 7.4.10 Configuring the failsafe mode

The menus **Diagnostics** (transmitter and **View filter** ("Teqwave Viewer" operating tool) contain functions to define how the device behaves when limit values are breached (under/over range). In addition, they also contain settings for the evaluation of the measurement results that are shown on the transmitter display.

Navigation on the transmitter

1. Settings menu → "Application parameters" → "Diagnostics" → "View options"
2. Settings menu → "Application parameters" → "Diagnostics" → "Change in" → Select measured variable
3. Settings menu → "Application parameters" → "Diagnostics" → "Process disturbance" → "Switch point"

Navigation via the "Teqwave Viewer" operating tool

1. Menu "Teqwave Transmitter" → View filter" → "Filter options" and "Filter arrangements"
2. Menu "Teqwave Transmitter" → "View filter" → "Change in" → Select measured variable
3. Menu "Teqwave Transmitter" → "View filter" → "Process disturbance" → "Switch point"



For detailed information on parameters, see the Operating Instructions for the device.

## 7.5 Advanced settings

Offset adjustments and compensations can be performed to increase the measurement accuracy. In addition, recipe management can be used to save combinations of settings as an initial setting or recipe for every fluid profile.

### 7.5.1 Recipe management

The recipe management contained in the "Teqwave Viewer" operating tool makes it possible to permanently assign default settings to an analysis parameter and from compensation values

to a fluid profile. Default settings include the unit, measuring range and offset as well as the channel selection of the analog interface via which the analysis parameter is output.

The default settings are saved as a recipe in RCP format in the working directory of the "Teqwave Viewer" operating tool. After saving, a recipe can be added to the transmitter such that the default setting is available there.

Any number of recipes can be created for each fluid profile. However, only a maximum of 25 fluid profiles or 50 fluid profiles and recipes can be used in combination.



To ensure recipes can be created for a fluid profile, it must be saved in the working directory of the "Teqwave Viewer" operating tool.

### Creating a recipe

1. Select the menu "Teqwave Viewer" → "Manage recipes".
  - ↳ The "Manage recipes" window appears.
2. Click the Plus icon to create a new recipe.
  - ↳ The "Create recipe" window appears.
3. Enter a unique name for the recipe in the "Recipe name" field. The name may contain a maximum of 64 characters, and can consist of any string of letters and numbers.
4. In the "Fluid profile" drop-down menu, select the fluid profile for which a recipe is to be created.
5. Record default settings.  
Under "Analysis parameter", set the analysis parameter → 42;  
set the compensation values → 42.
6. Use the "Save" button to save the recipe.
  - ↳ The RCP file is saved in the working directory of the "Teqwave Viewer" operating tool.  
When saving a new recipe, the recipe name is used as a default file name.  
When a processed recipe is saved, the existing RCP file is overwritten in the working directory. The file name remains unchanged.

### Configuring analysis parameters

For the analysis parameters calculated in a fluid profile, the unit, measuring range and offset can be preset and saved permanently via recipe management.

1. In the "Create recipe" window under "Analysis parameter" in the drop-down menu select the required analysis parameter and configure initial settings; see the Operating Instructions for the device.
2. If necessary, use the Plus icon to add additional analysis parameters and configure initial settings for these.

### Setting the compensation values

To increase measurement accuracy, predefined compensation values can be used for the compensation of the speed of sound depending on the application. The compensation values

can be read into a recipe from external measuring instruments via Modbus TCP or entered as constant measured values.

Typical compensation values are:

- CO<sub>2</sub> concentration
- Acid content



The compensation values are only available if they were provided in the data record of the fluid profile upon delivery.

- Set the compensation values in the "Compensation values" section of the recipe management, see the Operating Instructions for the device.

### Saving a comment

A comment can be added to a recipe. The comment is only visible in the "Teqwave Viewer" operating tool, not on the transmitter local display and is limited to 512 characters.

### Adding a recipe to the transmitter

The recipes created by the customer can be added to or removed from the transmitter via the "Manage fluid profile/recipes" function.

- Manage fluid profile; see the Operating Instructions for the device.

#### 7.5.2 Setting the compensation values

The compensation values available for a fluid profile can be set manually using the **Select fluid profile** (transmitter) menu. To use compensation values permanently in a recipe and for further information on the compensation values, see the recipe management → 41.

*Navigation on the transmitter*

Settings menu → "Select fluid profile" → Select fluid profile or recipe → "Compensation values" → Select compensation value



- The **Compensation value** function can only be accessed if the fluid profile has been activated beforehand.
- The compensation values are only available if they were provided in the data record of the fluid profile upon delivery.
- The compensation value is rejected when the fluid profile is changed. The value can only be retained via a recipe.



For detailed information on parameters, see the Operating Instructions for the device.

#### 7.5.3 Set the offset for the analysis parameter

The **Fluid profile settings** (transmitter) and **analysis parameter offset** ("Teqwave Viewer" operating tool) menus are used to configure the manual offsets for the calculated analysis parameters. This allows users to adapt the measuring technology to different process conditions (e.g. foreign substances/admixtures).

*Navigation on the transmitter*

Operational display → Fluid profile name → "Fluid profile settings" → "Analysis parameter 1...n offset"

*Navigation via the "Teqwave Viewer" operating tool*  
 Menu "Teqwave Transmitter" → "Analysis parameter offset" → "Offset"

-  ■ The operating tool communicates the settings to the transmitter as soon as the **Apply** button is clicked.
- For detailed information on parameters, see the Operating Instructions for the device.

# 8 Diagnostic information

## 8.1 General troubleshooting

### 8.1.1 For local display

| Fault                                                               | Possible causes                                                       | Remedial action                                                                                              |
|---------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Local display dark and no output signals.                           | Supply voltage does not match the voltage specified on the nameplate. | Apply the correct supply voltage.                                                                            |
| Local display is dark, but signal output is within the valid range. | Display is set too bright or too dark.                                | Set the display brighter or darker via the "Teqwave Viewer" operating tool using the "Brightness" parameter. |
|                                                                     | Display module is faulty.                                             | Contact Endress+Hauser Service.                                                                              |

### 8.1.2 For output signals

| Fault                                                                                                                        | Possible causes                             | Remedial action                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Signal output outside the valid range.                                                                                       | Incorrect configuration.                    | <ol style="list-style-type: none"> <li>1. Check the configuration and correct if necessary.</li> <li>2. Stay within the specifications of the outputs indicated in the "Technical data".</li> <li>3. Observe the failsafe mode of the outputs as indicated under "Failure signal" in the "Technical data" section.</li> </ol> |
| Measuring instrument shows correct value on the local display but the signal output is incorrect, though in the valid range. | Configuration error.                        | Check the configuration and correct if necessary.                                                                                                                                                                                                                                                                             |
| Measured value not stable                                                                                                    | Operation outside the range of application. | <ol style="list-style-type: none"> <li>1. Ensure homogeneous mixing of the liquid and its continuous flow to the sensor.</li> <li>2. Remove air bubbles and/or particles.</li> <li>3. Ensure the temperature value is stable.</li> </ol>                                                                                      |

| Fault                                                                                         | Possible causes                             | Remedial action                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                               | Unstable process conditions.                | Check the configuration of the "Averaging" parameter. Increase averaging if necessary.                                                                                                                                                   |
| The measuring instrument measures incorrectly or the value of the analysis parameter is zero. | Incorrect use of fluid profile app.         | Check the selected fluid profile and change the fluid profile if necessary.                                                                                                                                                              |
|                                                                                               | Communication error.                        | Restart the transmitter. In doing so, disconnect the device from the supply voltage for at least 30 seconds.                                                                                                                             |
|                                                                                               | Operation outside the range of application. | <ol style="list-style-type: none"> <li>1. Ensure homogeneous mixing of the liquid and its continuous flow to the sensor.</li> <li>2. Remove air bubbles and/or particles.</li> <li>3. Ensure the temperature value is stable.</li> </ol> |
|                                                                                               | Sensor is dirty.                            | Ensure that the sensor is free from dirt and deposit buildup.                                                                                                                                                                            |
|                                                                                               | Sensor is faulty.                           | <ol style="list-style-type: none"> <li>1. Check the sensor with the "Check sensor" function.</li> <li>2. Contact Endress+Hauser-Service if the limit value is exceeded.</li> </ol>                                                       |

### 8.1.3 For access via the "Teqwave Viewer" operating tool

| Problem                                                                                        | Possible causes                                                                       | Remedial action                                                            |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Not possible to connect to the "Teqwave Viewer" operating tool.                                | Cable is not connected.                                                               | Connect the network cable to the transmitter.                              |
|                                                                                                | Cable too long.                                                                       | Check the cable length (max. 30 m) and correct if necessary.               |
|                                                                                                | Internet protocol configured incorrectly.                                             | Check the configuration of the Internet protocol and correct if necessary. |
| The permanent connection to the "Teqwave Viewer" operating tool disconnected after a few days. | Internet protocol has been changed. Check the configuration of the Internet protocol. | Check the configuration of the Internet protocol and correct if necessary. |
|                                                                                                | Measuring instrument is connected to several operating tools.                         | Only establish a single link to maintain a permanent connection.           |
| Error message when running the "Read memory" function.                                         | Network connection has been interrupted.                                              | Ensure that the network connection is uninterrupted.                       |

| Problem                                                                  | Possible causes                              | Remedial action                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measured values from 1904 appear in the graph after reading the memory.  | Communication error or device memory faulty. | <ol style="list-style-type: none"> <li>1. Restart the transmitter. In doing so, disconnect the device from the supply voltage for at least 30 seconds.</li> <li>2. Read the memory again.</li> <li>3. If the error persists, contact Endress+Hauser Service.</li> </ol> |
| All measured values appear with the value zero after reading the memory. | Communication error or device memory faulty. | <ol style="list-style-type: none"> <li>1. Restart the transmitter. In doing so, disconnect the device from the supply voltage for at least 30 seconds.</li> <li>2. Read the memory again.</li> <li>3. If the error persists, contact Endress+Hauser Service.</li> </ol> |

## 8.2 Diagnostic information on local display and in operating tool

The transmitter with a touch screen and the "Teqwave Viewer" operating tool indicate errors and malfunctions by green, yellow and red indicators. Tap this sensor status to display the current messages in text format.

| Signal color | Diagnostic message                                         | Description                                                                                                                              | Measures                                                                                                                                                                                                                                                  |
|--------------|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green        | "Sensor Status OK"                                         | -                                                                                                                                        | -                                                                                                                                                                                                                                                         |
| Yellow       | "Change in temperature > [limit value]"                    | Temperature of liquid changes too quickly and configured limit value is exceeded. The calculated measured value may be incorrect.        | Ensure a stable medium temperature.                                                                                                                                                                                                                       |
|              | "Change in analysis parameter > [limit value]"             | Analysis parameter of liquid changes too quickly and configured limit value is exceeded. The calculated measured value may be incorrect. | Ensure that the analysis parameter has a stable value.                                                                                                                                                                                                    |
|              | "Process disturbance detected, dispersion > [limit value]" | The measured dispersion is greater than the configured switch point.                                                                     | <ol style="list-style-type: none"> <li>1. Remove air bubbles and/or particles.</li> <li>2. Take the recommended mounting position into consideration →  11.</li> </ol> |

| Signal color | Diagnostic message                                              | Description                                                                                                                                                                                                                                                                                 | Measures                                                                                                                                                                                                             |
|--------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | "Stationarity"                                                  | The value of the liquid analysis parameter changes too quickly and the measured value changes more frequently within 20 s than allowed by the statistical uncertainty considered in the measuring instrument. Settling processes can occur. The calculated measured value may be incorrect. | Ensure that the analysis parameter has a stable value.                                                                                                                                                               |
|              | "Measuring range [measured variable] < ; [measured variable] >" | The measured value is above or below the specified measuring range.                                                                                                                                                                                                                         | Select a measured value that is within the measuring range.                                                                                                                                                          |
|              | "Calibration [measured variable] < ; [measured variable] >"     | The measured value for the displayed measured variable is above or below the calibration range of the liquid and may therefore be incorrect.                                                                                                                                                | Select a measured value that is within the calibration range.                                                                                                                                                        |
|              | "Clock and storage faulty"                                      | Buffer battery is not charged.                                                                                                                                                                                                                                                              | <ol style="list-style-type: none"> <li>1. Supply power to the transmitter for a few hours.</li> <li>2. Then restart the transmitter.</li> <li>3. If the error persists, contact Endress+Hauser Service.</li> </ol>   |
|              | "Compensation not possible: Modbus communication faulty"        | Missing compensation value.                                                                                                                                                                                                                                                                 | <ol style="list-style-type: none"> <li>1. Check the functional integrity of the external measuring instruments.</li> <li>2. Check and guarantee Modbus communication with external measuring instruments.</li> </ol> |
|              | "Analog interface disabled"                                     | The analog interface is disabled.                                                                                                                                                                                                                                                           | Enable the interface by selecting a measured variable in the <b>Analog channel 1...4</b> parameter.                                                                                                                  |
|              | "Compensation value is incorrect"                               | Compensation calculation is not possible. Missing compensation value.                                                                                                                                                                                                                       | Enter the compensation value in the <b>Compensation value K1...K4</b> parameter.                                                                                                                                     |
| Red          | "No liquid present"                                             | No liquid is present.                                                                                                                                                                                                                                                                       | Ensure that there is sufficient liquid in the sensor.                                                                                                                                                                |
|              |                                                                 | Sensor is dirty.                                                                                                                                                                                                                                                                            | Ensure that the sensor is free from dirt and deposit buildup.                                                                                                                                                        |
|              |                                                                 | Air bubbles or particles in the liquid.                                                                                                                                                                                                                                                     | Remove air bubbles and/or particles.                                                                                                                                                                                 |

| Signal color | Diagnostic message                | Description                                                           | Measures                                                                                                                                                                                                                                                                                                                   |
|--------------|-----------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |                                   | Communication error                                                   | Restart the transmitter. In doing so, disconnect the device from the supply voltage for at least 30 seconds.                                                                                                                                                                                                               |
|              | "No sensor connected"             | The sensor is not connected.                                          | Make sure that the sensor is connected to the transmitter via the connecting cable.                                                                                                                                                                                                                                        |
|              |                                   | Connecting cable or connections are damaged.                          | Check the connecting cable and connections for damage.                                                                                                                                                                                                                                                                     |
|              |                                   | Communication error                                                   | Restart the transmitter. In doing so, disconnect the device from the supply voltage for at least 30 seconds.                                                                                                                                                                                                               |
|              | "Temperature chip is faulty"      | Sensor is faulty.                                                     | Contact Endress+Hauser Service.                                                                                                                                                                                                                                                                                            |
|              | "Temperature chip is faulty"      | Sensor is faulty.                                                     | Contact Endress+Hauser Service.                                                                                                                                                                                                                                                                                            |
|              | "Sensor memory faulty"            | Measuring instrument is initializing.                                 | Contact Endress+Hauser Service.                                                                                                                                                                                                                                                                                            |
|              | "Process disturbance"             | The value measured for the dispersion is greater than 1.              | <ol style="list-style-type: none"> <li>1. Remove air bubbles and/or particles.</li> <li>2. Take the recommended mounting position →  11 into consideration.</li> <li>3. If the error persists, contact Endress+Hauser Service.</li> </ol> |
|              | "Sensor configuration failed"     | Missing calibration.                                                  | Contact Endress+Hauser Service.                                                                                                                                                                                                                                                                                            |
|              | "System error"                    | Communication error between internal processors.                      | <ol style="list-style-type: none"> <li>1. Restart the transmitter.</li> <li>2. If the error persists, contact Endress+Hauser Service.</li> </ol>                                                                                                                                                                           |
|              | "Compensation value is incorrect" | Compensation calculation is not possible. Missing compensation value. | Enter the compensation value in the <b>Compensation value K1...K4</b> parameter.                                                                                                                                                                                                                                           |

### 8.3 Diagnostic information via dispersion indicator

The dispersion indicates a disturbance in the liquid caused by the dispersion of gas bubbles or particles. This causes a widening in the group and phase speed of sound.

The measuring instrument displays a standardized factor. If this value is less than 1, this indicates that the speed of sound determined for the undisturbed fluid can still be determined with the specified measurement error. On the other hand, the density measurement error can already be greater than the measurement error specified under reference conditions at values over 0.25.

If the measured dispersion is greater than the configured switch point, the measuring instrument no longer displays an analysis parameter. The configured switch point can be viewed as follows:



*Navigation on the transmitter*

- ▶ Settings → "Application parameters" → "Diagnostics" → "Process disturbance" → "Switch point"

*Navigation via the "Teqwave Viewer" operating tool*

- ▶ Menu "Teqwave Transmitter" → "View filter" → "Process disturbance" → "Switch point"

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